

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
WASHINGTON
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Letter
Circular
LC-539

SOUND ABSORPTION COEFFICIENTS OF THE MORE COMMON ACOUSTIC MATERIALS.

The following figures have been obtained at the National Bureau of Standards for the sound absorption coefficients of a number of acoustic materials. It is our intention to publish results only for materials which are on the market. The measurements on some of these materials were made several years ago, but we believe these materials are essentially the same as when the measurements were made. The inclusion of a material in this letter circular is not to be construed as a general approval. Each material should be judged on its merits in any particular case as there are other requirements such as fire resisting qualities; light reflection, appearance, etc. Figures are also given for the absorption of an audience seated in chairs of different kinds. All the results have been obtained by the reverberation method on samples having an area of approximately 72 square feet.

The sound absorption coefficient of a material is defined as the fractional part of the energy of a sound wave which is absorbed at each reflection. Experimental figures such as are given here must be regarded as approximate only. This branch of applied science is new and in a state of development. The methods and formulas used in obtaining these figures are those which, while not entirely satisfactory, are open to the least objection. The uncertainty involved is such that all the coefficients are probably somewhat too large.

The "noise coefficient" given in the table is the average to the nearest multiple of 0.05 of the coefficients for 256, 512, 1024 and 2048 cycles. It has been recommended by many consultants that such a coefficient be used when the problem is one of reducing the noise level, as in offices, restaurants, etc.

Fibrous materials and acoustic tiles may exhibit large variations in coefficient arising from different methods of mounting. The figures here given apply only to cases where the materials are mounted in the same manner as when tested.

Acoustic plasters require special skill in their application, as improper manipulation may reduce the coefficient. Particular attention is called to the fact that a dry base coat is used for most applications. Also the sound absorption coefficients are affected quite materially by the time between the application of the first and second coat of acoustic plaster.

It is not necessarily the case that the materials of highest coefficient are the most advantageous. When there is room enough to apply the requisite quantity, a material of low coefficient will give better results than one of higher absorption, because of the more uniform distribution

of material. Also, in comparing different materials it should be borne in mind that there is some variation in manufacture, hence the sample which was measured may have more or less absorption than the material delivered on the job. Minor differences in coefficients, therefore, should be disregarded in choosing between materials.

For the foregoing reasons it is advisable in drawing up specifications for auditoriums to lay emphasis upon the reverberation time desired rather than upon coefficients of material. See National Bureau of Standards Circular C418 entitled "Architectural Acoustics", which may be obtained of the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents per copy. Additional details regarding any of the materials mentioned in this letter circular will be furnished on application.

Additional information regarding the absorption coefficients of acoustical materials may be obtained from the Acoustical Materials Association, 919 North Michigan Avenue, Chicago, Illinois.

Sound Absorption Coefficients and Description of Test Samples

Table 1
Acoustical Tiles, Cast Materials, Boards and Blankets

ACOUSTICAL CORPORATION OF AMERICA									
Material	Thick- ness	Mounting (See Footnote)	Coefficients		Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
Mutetile (2" Rockwool)	2 1/2"	4	128	256	512	1024	2048	4096	
			.53	.71	.80	.78	.76	.45	.75
						12"x 12"	--	Cast plaster of paris perforated 2556 holes per sq ft, dia. 1/16".	1932
ACoustONE COMPANY, LTD.									
Trutone Tile, cast on 1/4" gypsum wall board	7/8"	4	.16	.17	.48	.82	.65	.74	.55
						12"x 24"	--	Spray painted by manufacturer.	1932
AMERICAN GYPSUM CO.									
Muffletone, Standard Finish	1"	1	.19	.45	.84	.87	.83	.88	.75
						12"x 12"	1.83	Painted by mfr.	1938
Muffletone, Standard Finish	3/4"	1	.13	.36	.65	.62	.70	.69	.60
						12"x 12"	1.62	Unpainted.	1938
Muffletone, Standard Finish	1"	1	.15	.46	.75	.80	.72	.68	.70
						12"x 12"	1.84	Unpainted.	1938
Muffletone, Standard Finish	1"	1	.13	.44	.78	.80	.75	.82	.70
						12"x 12"	1.84	Spray painted 3 coats at N.E. of S.	1938
Muffletone, Travertine Finish	1"	1	.16	.45	.71	.69	.71	.70	.65
						12"x 12"	1.96	Unpainted.	1938
Muffletone, Travertine Finish	1"	1	.16	.44	.68	.69	.69	.71	.65
						12"x 12"	1.96	Spray painted 3 coats at N.E. of S.	1938
ARMSTRONG CORK & INSULATION COMPANY									
Ceramacoustic Tile	1 1/8"	1	.34	.48	.63	.66	.65	.58	.60
						4 1/2" x 9"	3.4	Unpainted	1932
Ceramacoustic Tile	1 1/8"	1	.28	.49	.62	.62	.66	.54	.60
						4 1/2" x 9"	3.4	Spray painted 4 coats at N.E. of S.	1932

ARMSTRONG CORK & INSULATION COMPANY (Cont'd)

Material	Thickness	Mounting (See Footnote)	Coefficients				Noise Coef.	Size of Unit		Surface	Date
			128	256	512	1024		Tested	Wt. (lb) sq ft		
Corkoustic Tile	1 1/2"	1	.08	.23	.70	.61	.52	12" x 12"	.83	Painted by mfr.	1936
Temlock	1 1/2"	5	.24	.31	.27	.27	.47	--	--	Unpainted.	1931
		(16" o.c.)									
Temlock Deluxe	1 1/2"	4	.12	.24	.39	.31	.32	48" x 54"	1.18	Painted by mfr.	1937
Temlock Deluxe	7/8"	4	.22	.46	.35	.32	.57	48" x 54"	1.19	" "	1937
Temlock Deluxe	1 3/8"	4	.32	.45	.37	.39	.63	48" x 54"	1.65	" "	1937
BASALT ROCK COMPANY											
Basalt Rock	5"	4	.32	.81	.75	.73	.74	18" x 24"	25.2	Unpainted	1938
Type A											
SAMUEL CABOT, INC.											
Cabots Quilt	--	4	.12	.30	.69	.82	.41	--	.41	Covered with paper.	1938

THE CELOTEX CORPORATION

Absorbex Type A on 1" Absorbex Type F (10 gauge)	2"	4	--	.39	.80	.96	.92	--	.75	9" x 9" tile on 20" x 64" sheets.	--	Spray painted by mfr.	1932
Absorbex Type A	1"	1	--	.22	.45	.87	.91	--	.60	9" x 9"	2.5	Spray painted by mfr.	1932
Absorbex Type A	1"	9	.19	.63	.95	.86	.78	18" x 18"	.80	18" x 18"	2.6	Unpainted	1936
Absorbex Type A	1"	2	.19	.33	.80	.86	.80	18" x 18"	.70	18" x 18"	2.7	Kerfed, spray painted 4 coats paint at N.B. of S.	1936
		(18" o.c.)										Unpainted	1932
Absorbex Type C	1"	4	.14	.19	.34	.73	.62	20" x 64"	.45	20" x 64"	--	Unpainted	1932
Absorbex Type C	1"	2	.14	.21	.67	.69	.59	20" x 64"	.55	20" x 64"	--	Unpainted	1932
		(20" o.c.)											
Absorbex Type F	1"	2	.06	.17	.47	.66	.53	20" x 64"	.45	20" x 64"	--	Spray painted by mfr.	1934
		(16" o.c.)											
Absorbex Type F	2"	7	.13	.47	.98	.70	.78	20" x 64"	.75	20" x 64"	4.7	Spray painted 4 coats paint at N.B. of S.	1934
		(8 gauge)										Unpainted, perforated 441 holes per sq ft, 1/4" dia., 5/8" deep.	1931
Acousti-Celotex Type C5	13/16"	1	.15	.24	.62	.73	.70	12" x 12"	.55	12" x 12"	--		

THE CELOTEX CORPORATION (Cont'd)

Material	Thick- ness	Mounting (See Footnote)	Coefficients				Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
Acousti-Celotex Type C5	13/16"	1	.13	.26	.62	.78	.86	.77	.65	12"x 12"	1931
										Same as sample above, brush painted 1 coat glue size, 4 coats lead and oil at N.E. of S.	1931
Acousti-Celotex Type C5	13/16"	2	.09	.56	.77	.90	.78	.62	.75	12"x 12"	1931
										Unpainted, perforated 441 holes per sq ft, 1/4" dia., 5/8" deep.	1931
Acousti-Celotex Type C6	1 1/4"	4	.12	.41	.90	.92	.66	.64	.70	12"x 12"	1932
										Unpainted, perforated 441 holes per sq ft, 1/4" dia., 1" deep.	1932
Acousti-Celotex Type C1	1 1/2"	1	.12	.26	.48	.50	.46	.56	.45	12"x 12"	1936
										R.I. finish, perforated 441 holes per sq ft, 3/16" dia., 3/8" deep.	1936
Acousti-Celotex Type C1	1 1/2"	1	.17	.24	.40	.45	.43	.51	.40	12"x 12"	1936
Slow-burning Acousti-Celotex Type C2	1 1/16"	1	.11	.31	.71	.80	.67	.57	.60	12"x 12"	1936
										Unpainted, perforated 441 holes per sq ft, 3/16" dia., 3/8" deep.	1936
Acousti-Celotex Type C2	1 1/16"	2	.14	.65	.63	.73	.67	.55	.65	12"x 12"	1936
										Unpainted, perforated 441 holes per sq ft, 3/16" dia., 1/2" deep.	1936
Acousti-Celotex Type C2	5/8"	1	.09	.25	.68	.79	.69	.66	.60	12"x 12"	1937
Slow burning Acousti-Celotex Type C3	13/16"	1	.18	.32	.76	.93	.63	.50	.65	12"x 12"	1938
										R.I. finish, perforated 441 holes per sq ft, 3/16" dia., 5/8" deep.	1938
Acousti-Celotex Type C3	13/16"	3	.55	.66	.66	.80	.69	.52	.70	12"x 24"	1938
										R.I. finish, perforated 441 holes per sq ft, 3/16" dia., 5/8" deep.	1938

THE CELOTEX CORPORATION (Cont'd)

Material	Thickness	Mounting (See Footnote)	Coefficients				Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
			128	256	512	1024					
Acousti-Celotex Type C3	13/16"	1	.18	.36	.67	.74	.67	12"x 12"	1.35	Unpainted, perforated 441 holes per sq ft	1936
Slow-burning Acousti-Celotex Type C3	13/16"	8	.45	.58	.67	.91	.71	12"x 24"	1.06	3/16" dia., 5/8" deep. Unpainted, perforated 441 holes per sq ft,	1937
Slow-burning Acousti-Celotex Type C4	1 1/4"	1	.17	.48	.97	.72	.50	12"x 12"	1.58	3/16" dia., 5/8" deep. R.I. finish, perforated 441 holes per sq ft,	1936
Acousti-Celotex Type C4	1 1/4"	8	.53	.68	.96	.78	.60	12"x 24"	1.44	3/16" dia., 1 1/16" deep. R.I. finish, perforated 441 holes per sq ft,	1936
Acousti-Celotex Type C4	1 1/4"	1	.13	.51	.94	.84	.58	12"x 12"	1.80	3/16" dia., 1 1/16" deep. Unpainted, perforated 441 holes per sq ft,	1936
Slow burning Acousti-Celotex Type MU-1	1/2"	1	.10	.17	.53	.68	.66	12"x 12"	1.39	3/16" dia., 1 1/16" deep. Unpainted, not perforated.	1936
Acousti-Celotex Type M1	9/16"	1	.11	.29	.68	.74	.82	12"x 12"	1.23	Painted by mfr., perforated 676 holes per sq ft, 5/32" dia., 1/2" deep.	1936
Acousti-Celotex Type M3	1 1/4"	1	.15	.50	.93	.89	.74	12"x 12"	2.58	Painted by mfr., perforated 676 holes per sq ft, 5/32" dia., 1 1/8" deep.	1936
Calicel Acoustic Tile	3/4"	1	.07	.21	.62	.90	.75	12"x 12"	-	Unpainted.	1936
Calicel Acoustic Tile	1"	1	.09	.26	.74	.97	.78	12"x 12"	2.66	Unpainted.	1935
Calicel Acoustic Tile	1	5 (12" o.c.)	.28	.90	.86	.72	.85	12"x 12"	2.66	Unpainted.	1935
Calicel Acoustic Tile	1 1/4"	1	.14	.43	.90	.90	.82	12"x 12"	3.42	Unpainted.	1935
Calicel Acoustic Tile	1 1/4"	5 (12" c.c.)	.38	.95	.76	.78	.89	12"x 12"	3.42	Unpainted.	1935

THE CELOTEX CORPORATION (Cont'd)

Material	Thick- ness	Mounting (Sec Footnote)	Coefficients					Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
			128	256	512	1024	2048	4096				
Calistone	2"	4	.12	.45	.87	.82	.76	.67	.75	12"x 12"	Unpainted	1935
Calistone	2"	5	.46	.91	.71	.75	.84	.72	.80	12"x 12"	Unpainted	1935
		(12" o.c.)										
Calistone	4"	4	.38	.59	.60	.63	.63	.62	.60	18"x 24"	Unpainted	1937
Calistone	5"	4	.45	.37	.81	.50	.78	.81	.80	18"x 24"	Unpainted	1937
CERTAIN-TEED PRODUCTS CORPORATION												
Kalite, cast on 1/4" backing of moulding plaster, Grade D(fine)	1"	4	.09	.30	.49	.54	.47	.48	.45	24"x 36"	Unpainted	1936
Kalite, cast on 1/4" backing of moulding plaster, Grade A(Coarse)	1"	4	.06	.19	.42	.69	.74	.64	.50	24"x 36"	Unpainted	1936
Kalite, cast on 1/4" backing of moulding plaster, Grade D(Fine)	1 1/2"	4	.20	.39	.59	.61	.60	.67	.55	24"x 36"	Unpainted	1936
Kalite, cast on 1/4" backing of moulding plaster, Grade A(Coarse)	1 1/2"	4	.15	.34	.64	.74	.60	.69	.60	24"x 36"	Unpainted	1936
Kalite, cast on 1/4" backing of moulding plaster, Grade D(Fine)	2"	4	.22	.48	.55	.58	.54	.53	.55	24"x 36"	Unpainted	1936
Kalite, cast on 1/4" backing of moulding plaster, Grade A(Coarse)	2"	4	.23	.55	.73	.67	.64	.62	.65	24"x 36"	Unpainted	1936
Kalite, cast on 1/4" backing of moulding plaster, Grade A(Coarse)	2"	4	.26	.51	.72	.69	.67	.71	.65	24"x 36"	Spray painted 4 coats of Mural- tone paint.	1937

CORK INSULATION COMPANY, Inc.

Material	Thick- ness	Mounting (See Footnote)	Coefficients			Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
			123	256	512	1024	2048	4096		
Corinco Acousticator	1 1/2"	1	.07	.20	.53	.39	.37	.35	1.20	1938
Corinco Acousticator	1 1/2"	2	.10	.58	.35	.34	.31	.42	1.07	Spray painted by manufacturer.
Corinco Coribestos	1 1/2"	2	.22	.69	.57	.53	.65	.63	1.12	Unpainted

CORNING GLASS COMPANY

Corning Glass Mineral Wool Acoustic Blankets	1"	4	.27	.63	.75	.75	.78	.75	.75	.44	Covered with thin muslin.	1938
Corning Glass Mineral Wool Acoustic Blankets	2"	4	.34	.72	.87	.87	.75	.70	.80	.72	"	1938
Corning Glass Mineral Wool Acoustic Blankets	3"	4	.39	.91	.97	.91	.82	.85	.90	1.07	"	1938

THE FEATHERS COMPANY, Inc.

Felt	1"	4	.11	.40	.80	.84	.78	.98	.70	.96	No surface covering.	1938
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P. GUASTAVINO COMPANY

Akoustolith Tile Grade D	1"	4	.08	.13	.25	.54	.67	.42	.40	-	Unpainted	1930
Akoustolith Tile Grade D	2"	4	.15	.26	.59	.74	.52	.50	.55	-	Unpainted	1930
Akoustolith Tile Grade C	1 1/2"	4	.12	.19	.44	.61	.66	.56	.50	7.5	Unpainted	1930
Akoustolith Tile Grade C	2"	4	.19	.26	.53	.64	.70	.56	.55	10.1	Unpainted	1930
Akoustolith Tile Grade B-2	1"	4	.09	.17	.46	.77	.77	.58	.55	4.6	Unpainted	1932
Akoustolith Tile Grade B-2	1 1/2"	4	.14	.30	.67	.87	.82	.57	.65	6.1	Unpainted	1932
Akoustolith Tile Grade B-2	2"	4	.21	.50	.85	.81	.70	.70	.70	8.5	Unpainted	1932

R. GUASTAVINO COMPANY (Cont'd)

Material	Thickness	Mounting (See Footnote)	Coefficients						Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
			128	256	512	1024	2048	4096					
Akoustolith Tile Grade B-1	2"	5 (12" o.c.)	.42	.75	.67	.75	.30	.73	.75	6"x 12"	9.4	Unpainted	1936
Akoustolith Tile Grade B-1	1 1/4"	5 (12" o.c.)	.41	.83	.78	.72	.78	.82	.80	6"x 12"	5.8	Unpainted	1936
Akoustolith Tile Grade C	4"	10 Not nailed	.54	.70	.78	.85	.83	.81	.80	12"x 12"	19.5	Unpainted	1937
Akoustolith Tile Grade C	4"	4	.32	.82	.90	.77	.79	.81	.80	12"x 12"	19.5	Unpainted	1937
Akoustolith Tile Grade C	5"	4	.43	.92	.91	.88	.86	.74	.90	12"x 12"	24.4	Unpainted	1937
Akoustolith Tile Grade C	5"	5 Not nailed	.67	.80	.96	.93	.80	.87	.85	12"x 12"	24.4	Unpainted	1937
Akoustolith Tile Grade C	5"	10	.60	.80	.95	.91	.90	.78	.90	12"x 12"	24.4	Unpainted	1937
Akoustolith Tile Grade D	4"	10	.54	.80	.70	.88	.87	.74	.80	12"x 12"	18.8	Unpainted	1937
Akoustolith Tile Grade D	4"	4	.27	.76	.93	.78	.74	.69	.86	12"x 12"	18.8	Unpainted	1937

HAWAIIAN CANE PRODUCTS, Ltd.

Hawaiian Cane Tile	1"	1	.10	.40	.69	.78	.77	.79	.65	11½" x 11½"	0.75	Unpainted	1933
Hawaiian Cane Tile	1"	2	.24	.70	.40	.43	.54	.60	.55	12" x 12"	.81	Unpainted	1935

THE INSULT COMPANY

	DATE	QUANTITY	COLOR	FINISH	PRICE	REMARKS
Insulate Acoustilo 1	3/4"	4	.26	.42	.50	.57 .61 .59 .55 12"x 12" 1.47 Unpainted 1931
Type 444						

JOHNS-MANVILLE SALES CORPORATION

Material	Thick- ness	Mounting (See Footnote)	Coefficients							Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
			128	256	512	1024	2048	4096						
Air-Acoustic Sheets	1/2"	11	.14	.45	.53	.70	.67	.70	.60	18"x 24"	.80	Unpainted	1938	
Air-Acoustic Sheets	1"	11	.31	.55	.70	.74	.76	.76	.70	18"x 24"	1.51	Unpainted	1938	
Fibretex Type 3OR	5/8"	2	.11	.20	.59	.91	.85	.72	.65	12"x 12"	1.34	Unpainted	1938*	
Fibretex Type 4OR	3/4"	1	.06	.17	.37	.68	.82	.74	.50	12"x 12"	1.75	Unpainted	1938*	
Fibretex Type 4OR	3/4"	2	.15	.22	.61	.93	.79	.69	.65	12"x 12"	1.54	Unpainted	1938*	
Fibretex Type 5OR	7/8"	2	.13	.28	.70	.98	.85	.87	.70	12"x 12"	1.79	Unpainted	1938*	
Fibretex Type 6OR	1"	1	.07	.24	.55	.87	.86	.88	.65	12"x 12"	-	Unpainted	1937*	
Fibretex Type 6OR	1"	2	.11	.33	.77	.92	.70	.96	.70	12"x 12"	2.07	Unpainted	1936*	
		(1"x 3" furring)												
Nashkote A	1/2"	1	.05	.13	.25	.26	.20	.18	.20	36"x 48"	-	Painted 2 coats oil paint.	1929	
Nashkote A	1/2"	1	.08	.15	.43	.62	.65	.58	.45	30"x 48"	-	Same as above except mem- brane perforated with fine holes after painting.	1929	
Nashkote A	3/4"	1	.09	.16	.27	.30	.23	.23	.25	36"x 48"	-	Painted 2 coats oil paint.	1929	
Nashkote A	3/4"	1	.11	.21	.51	.68	.71	.68	.55	30"x 48"	-	Same as above except mem- brane perforated with fine holes after painting.	1929	
Nashkote A	1"	1	.12	.20	.33	.33	.28	.28	.30	36"x 48"	-	Painted 2 coats oil paint.	1929	
Nashkote A	1"	1	.13	.26	.58	.73	.77	.71	.60	36"x 48"	-	Same as above except mem- brane perforated with fine holes after painting.	1929	
Permacoustic	1"	5 (Not nailed)	.27	.74	.66	.82	.70	.70	.75	12"x 12"	2.33	Unpainted	1938	
Permacoustic	1"	1	.20	.62	.83	.74	.77	.80	.75	12"x 12"	2.33	Unpainted	1938	
Rockoustile	1"	1	.09	.27	.70	.79	.65	.77	.60	12"x 12"	1.3	Unpainted	1938	
Rockoustile	7/8"	1	.10	.21	.65	.93	.69	.83	.60	12"x 12"	-	Unpainted	1938	
Sanaacoustic, Pad plus metal facing, pad supports, & furring 2 1/2"	1 1/4"	3	.14	.55	.92	.89	.84	.75	.80	12"x 24"	Pad 1.2	Perforated enameled metal surface 4608 holes per sq ft.	1938	

*These values are based on tests of Acoustex manufactured by the National Gypsum Company. Fibretex is the trade name used for this material by Johns-Manville Sales Corporation.

JOHNS-MANVILLE SALES CORPORATION (Cont'd)

Material	Thickness	Mounting (See Footnote)	Coefficients				Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
			128	256	512	1024					
Sound Isolation	-	4	.11	.58	.85	.83	.81	.83	1.5	Metal lath	1932
Blanket (Rockwool)											
Studio Element	1"	4	.16	.54	.72	.74	.71	.81	1.47	No covering	1937
Transite Acousti- cal Units	1 1/8"	4	.19	.39	.77	.74	.70	.55	3.6	Transite, perforated 576 holes per sq ft, diameter 5/32"	

DAVID E. KENNEDY, Inc.

Kencoustex	1"	1	.12	.21	.40	.64	.73	.72	.50	11 1/2" x 11 1/2"	1.46	Unpainted	1938
Kenkoustic (cork)	1 1/2"	1	.09	.16	.66	.64	.50	.62	.50	12" x 36"	.88	Unpainted	1938
KenKeustone	1"	1	.06	.10	.31	.29	.19	.25	.20	5 1/2" x 11 1/2"	2.34	Painted by mfr.	1938

LUSE STEVENSON COMPANY

Lusco Hair Felt	1"	4	.06	.27	.57	.77	.81	.88	.60	4' x 9'	-	No surface covering	1934
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MAIZEWOOD PRODUCTS CORPORATION

Maizewood Tile	1 1/2"	4	.23	.41	.63	.79	.70	.62	.65	12" x 12"	2.1	12 saw cuts across tile 1" deep.	1932
Maizewood Tile	1 1/2"	4	.21	.41	.64	.73	.70	.58	.60	12" x 12"	2.1	Same sample as above painted 1 coat glue size, 2 coats lead and oil at N.B. of S.	1932

NATIONAL GYPSUM COMPANY

Acoustex Type 30R	5/8"	2	.11	.20	.59	.91	.85	.72	.65	12" x 12"	1.34	Unpainted	1938
Acoustex Type 40R	3/4"	1	.06	.17	.37	.68	.82	.74	.50	12" x 12"	1.75	Unpainted	1938
Acoustex Type 40R	3/4"	2	.15	.22	.61	.93	.79	.69	.65	12" x 12"	1.54	Unpainted	1938
Acoustex Type 50R	7/8"	2	.13	.28	.70	.98	.85	.87	.70	12" x 12"	1.79	Unpainted	1938
Acoustex Type 60R	1"	1	.07	.24	.55	.87	.86	.88	.65	12" x 12"	-	Unpainted	1937
Acoustex Type 60R	1"	2	.11	.33	.77	.92	.70	.96	.70	12" x 12"	2.07	Unpainted	1936

(1" x 3" furrings)

NATIONAL GYPSUM COMPANY (Cont'd)

Material	Thickness	Mounting (See Footnote)	Coefficients				Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
			128	256	512	1024					
Acoustolic (Maftex)	1/2"	5	.44	.24	.31	.44	.48	.37	-	Unpainted	1930
Acoustolic	1/2"	5 (24" o.c.)	-	.29	.28	.41	-	-	-	Tinted with water soluble aniline color at N.B. of S.	1930
Acoustolic	1/2"	5 (24" o.c.)	.40	.33	.31	.38	.37	.35	-	Painted with cold water paint at N.B. of S.	1930

NORRISTOWN MAGNESIA & ASBESTOS COMPANY

Nodin Type B	1"	1	.13	.38	.76	.85	.78	.37	.75	12" x 12"	1.71	Unpainted	1938
Nodin Type B	1"	12	.25	.62	.76	.88	.63	.34	.70	12" x 12"	1.54	Unpainted	1938
Nodin Type B	1"	12	.31	.65	.79	.86	.66	.34	.75	12" x 12"	1.54	Brush painted 2 coats at N.B. of S.	1938

SOUND CONTROL CORPORATION

Softone Tile	1"	1	.07	.25	.65	.84	.72	.83	.60	12" x 12"	1.40	Spray painted by mfr.	1937
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THE SPHINX ACoustICAL COMPANY

Sphinxstone	2"	4	.10	.33	.78	.87	.71	.70	.65	18" x 24"	-	Unpainted	1932
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UNITED STATES GYPSUM COMPANY

Acoustone Type D	1/2"	1	.05	.14	.53	.75	.75	.74	.55	12" x 12"	.76	Unpainted	1937
Acoustone Type D	3/4"	1	.10	.36	.73	.78	.75	.76	.65	12" x 12"	1.26	Unpainted	1937
Acoustone Type D	7/8"	1	.14	.46	.75	.77	.84	.82	.76	12" x 12"	1.52	Unpainted	1938
Acoustone Type D	1"	1	.13	.48	.85	.83	.80	.85	.75	12" x 12"	1.73	Unpainted	1936
Acoustone Type W	1"	1	.11	.34	.86	.95	.87	.87	.75	12" x 12"	1.35	Unpainted	1938
Quietile Type 80	1"	4	.06	.47	.76	.74	.72	.76	.65	12" x 12"	0.81	Unpainted, brush finish.	1932
Red Top Acoustic Tile	1/2"	1	.14	.22	.40	.48	.52	.51	.40	12" x 12"	0.55	Unpainted	1932

UNITED STATES GYPSUM COMPANY (Cont'd)

Material	Thick- ness	Mounting (See Footnote)	Coefficients				Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date	
			123	256	512	1024						
Thermofil	3"	4	.43	.39	.66	.78	.81	.93	.65	12"x 12"	No surface covering.	1932
U.S. Gypsum Metal Tile, Rockwool pad. (Perfatone)	1 1/2"	4	.12	.56	.91	.87	.78	.70	.80	1.03 (Pad)	Perforated enameled metal 2401 holes per sq ft	1933

WILSON AND COMPANY, Inc.

Soundex	1"	9 (16" o.c.)	.19	.51	.87	.94	.84	.87	.80	16"x 16"	2.06	Unpainted	1938
Soundex	1"	2 (16" o.c.)	.13	.26	.61	.39	.78	.91	.65	16"x 16"	2.06	Unpainted	1938
Soundex	1"	2 (16" o.c.)	.10	.27	.61	.88	.71	.89	.65	16"x 16"	2.06	Spray painted 2 coats at N.B. of S.	1938
Soundex	1 1/8"	10 (16" o.c.)	.27	.94	.80	.77	.84	.87	.85	16"x 16"	2.36	Painted by mfr.	1938

WOOD CONVERSION COMPANY

Balsam Wool	1"	4	.18	.36	.55	.65	.67	—	.55	—	.29	Screen facing	1931
Krexstone Tile (Balsam Wool)	1"	6	.12	.24	.62	.73	.73	.78	.60	12"x 12"	0.83	Screen wire	1931
Nuwood Bevel Lap Tile	1/2"	6	.12	.19	.30	.40	.40	.51	.30	12"x 12"	0.69	Unpainted	1931
Nuwood Bevel Lap Tile	1"	6	.14	.19	.37	.37	.41	.56	.35	12"x 12"	1.41	Unpainted	1931

FOOTNOTES:

1. Cemented to gypsum wall board. This is considered equivalent to cementing to plaster or masonry.
2. Nailed on 13/16" x 2" furring 12" o.c. unless otherwise indicated.
3. Metal supports attached to 13/16" x 2" wood furring.
4. Laid directly on laboratory floor. As a rule the results obtained this way are the same as when the tile is cemented to gypsum wall board.
5. Nailed on 2 x 4's 12" o.c. unless otherwise indicated.
6. Cemented to the floor of the reverberation chamber.
7. Back of sample covered with concrete.
8. Attached to metal suspension system. 4" air space back of tile.
9. Acoustic tile nailed to 13/16" x 2" furring 18" o. c. Space between furring filled with Rockwool.
10. Laid on 2 x 8's 12" o. c.
11. Laid on 24 gauge sheet iron, nailed to 13/16" x 2" furring 24" o.c.
12. Clipped at corners to 5/8" x 1 3/8" metal furring 12" o.c. Furring was clipped to 1 1/2" channels which were 3'6" o.c.

Table 2

Acoustical Plasters

Unless otherwise stated each sample of acoustical plaster was mixed according to the specifications furnished by the manufacturers and applied by a skilled plasterer on a false ceiling at the N. B. of S. The panels were laid on the floor of the Reverberation Chamber for test.

THE AMERICAN GYPSUM COMPANY											
Material	Thick- ness	Coefficients				Noise No. Coef. of Coats	Base Coat	Application	Surface Treatment	Date	
		128	256	512	1024						2048
Reverbolite (Regular)	1/2"	.19	.29	.51	.76	.99	.78	.55	1st coat 1/4" 2nd coat 1/4" gypsum plaster on metal lath.	1st coat applied on dry base coat, 2nd coat applied as soon as first coat had set.	Finished with steel trowel. 1936
Reverbolite (Pumice aggregate)	1/2"	.18	.29	.41	.51	.55	.65	.45	1st coat 1/4" 2nd coat 1/4" gypsum plaster on metal lath.	1st coat applied on dry base coat. 2nd coat applied 24 hours after 1st coat.	Brushed with rice post finish then finished with steel trowel 1933
CALIFORNIA STUCCO PRODUCTS OF NEW ENGLAND, Inc.											
Stuccoastic Plaster Type A.D.	3/4"	.18	.36	.55	.65	.62	.62	.55	1st coat 7/16" 2nd coat 5/16" Gypsum plaster.	1st coat applied to half green base coat. 2nd coat applied 3 hours after 1st coat.	Troweled with steel trowel. 1935
CERTAIN-TEED PRODUCTS CORPORATION											
Kalite H Coarse Aggregate	1/2"	.36	.33	.46	.70	.66	.68	.55	1st coat 3/8" 2nd coat 1/8" Gypsum plaster on metal lath, attached to 1" channels.	1st coat applied to dry base coat. 2nd coat applied 1 hour after 1st coat.	Finished with steel trowel. 1935

CERTAIN-TEED PRODUCTS CORPORATION (Cont'd)

Material	Thick- ness	Coefficients				Noise No. Coef. of Coats	Base Coat	Application	Surface Treatment	Date		
		128	256	512	1024							
Kalite H Coarse Aggregate	1/2"	.26	.31	.46	.67	.65	.68	.50	1st coat 3/8" 2nd coat 1/8"	Same sample as above.	Brush painted 2 coats non- bridging lacquer. Finished 1935 with steel trowel.	1936
Kalite H Coarse Aggregate	3/4"	.43	.38	.63	.78	.65	.70	.60	1st coat 5/8" 2nd coat 1/8"	Gypsum 1st coat applied to plaster dry base coat. 2nd on metal coat applied 1 hr. lath after 1st coat. attached to 1" channels.		
CLEVELAND GYPSUM SUPPLY COMPANY												
Hushkote Acoustic Plaster	1/2"	.13	.24	.45	.71	.56	.49	.50	1st coat 1/4" 2nd coat 1/4"	1st coat applied to dry base coat. 2nd coat applied 24 hrs. after 1st coat.	Finished 1935 with steel trowel.	1935
Hushkote Acoustic Plaster	5/8"	.16	.34	.50	.53	.43	.37	.45	1st coat 3/8" 2nd coat 1/4"	1st coat applied to dry base coat. 2nd coat applied 24 hrs. after 1st coat.	Finished 1937 with steel trowel.	1937
Hushkote Acoustic Plaster	3/4"	.28	.36	.45	.50	.53	.57	.45	1st coat 1/4" 2nd coat 1/4" 3rd coat 1/4"	1st coat applied to dry base coat. 2nd coat applied 5 days after first coat. 3rd coat applied 3 days after 2nd coat.	Finished 1938 with steel trowel.	1938

R. GUASTAVINO COMPANY

Material	Thick- ness	Coefficients			Noise Coef.	No. of Coats	Base Coat	Application	Surface Treatment	Date		
123 255 512 1.24 2045 4096												
Alkoustolith Plaster	1/4"	.13	.21	.19	.23	.33	.45	.25	1 coat Gypsum plaster.	Applied on binder coat. See mfg. directions.	Floated	1931
Alkoustolith Plaster	3/4"	.20	.25	.35	.56	.59	.50	.45	1 coat Gypsum plaster.	Applied on binder coat. See mfg. directions.	Floated	1932

GYPSUM INSULATION AND MANUFACTURING COMPANY

Super- Acoustic Plaster	1/2"	.12	.24	.45	.71	.62	.63	.50	1st coat 1/4"	1st coat applied to dry base coat.	Finished with cork float.	1938
									2nd coat 1/4"	2nd coat applied 24 hours after 1st coat.		

NATIONAL GYPSUM COMPANY

Macoustic Plaster (Trowel Finish)	1/2"	.15	.27	.42	.45	.36	.29	.40	1st coat 1/4"	1st coat applied to half green base coat. 2nd coat applied 2 hours after 1st coat.	Finished with steel trowel.	1936
									2nd coat 1/4"			
Macoustic Plaster (Trowel Finish)	1/2"	.17	.27	.52	.76	.66	.55	.55	1st coat 1/4"	1st coat applied to dry base coat.	Finished with steel trowel.	1937
									2nd coat 1/4"	2nd coat applied 24 hrs. after 1st coat.		
Macoustic Plaster (Trowel Finish)	3/4"	.25	.41	.67	.63	.52	.47	.55	1st coat 3/8"	1st coat applied to dry base coat.	Finished with steel trowel.	1937
									2nd coat 3/8"	2nd coat applied 24 hrs. after 1st coat.		

NATIONAL GYPSUM COMPANY (cont'd)

Material	Thick- ness	Coefficients							Noise Coef.	No. of Coats	Base Coat	Application	Surface Treatment	Date
		128	256	512	1024	2048	4096							
Rockwall Acoustic Plaster	1/2"	.31	.36	.39	.42	.44	.41	.40	1st coat 1/4" 2nd coat 1/4"	3/4" Gypsum plaster on metal lath, attached to 1" channels.	1st coat applied to dry base coat. 2nd coat applied 24 hrs after 1st coat.	Finished with cork float.	1938	
Rockwall Acoustic Plaster	1/2"	.13	.20	.35	.65	.70	.64	.50	1st coat 1/4" 2nd coat 1/4"	3/4" Gypsum plaster on metal lath.	1st coat applied to dry base coat. 2nd coat applied 3 hours after 1st coat.	Finished with steel trowel.	1935	

NEWARK PLASTER COMPANY

Old Newark Acoustic Plaster	1/2"	.13	.21	.42	.70	.67	.69	.50	1st coat 1/4"	5/4" Gypsum plaster on metal lath.	1st coat applied to dry base coat. 2nd coat applied 24 hours after 1st coat.	Finished with steel trowel.	1937
Old Newark Acoustic Plaster	3/4"	.16	.34	.63	.74	.73	.72	.60	1st coat 1/4"	3/4" Gypsum plaster on metal lath.	1st coat applied to dry base coat. 2nd coat applied 24 hours after 1st coat. 3rd coat applied 24 hours after 2nd coat	Finished with steel trowel.	1938

PACIFIC PORTLAND CEMENT CO.

Material	1/2"	.15	.28	.44	.67	.66	.50	1st coat 1/4"	3/4"	1st coat applied to dry base coat. 2nd coat applied 72 hours after 1st coat.	Finished 1956
Calacoustic Plaster									Gypsum plaster on metal lath.		

UNITED STATES GYPSUM COMPANY

Material	Thickness	Coefficients					Noise Coef.	No of Coats	Base Coat	Application	Surface Treatment	Date
		128	256	512	1024	2048						
Sabinito Plaster Hydraulic	1/2"	.14	.24	.27	.35	.48	.64	.35	1st coat 1/4" 2nd coat 1/4"	Gypsum plaster.	1st coat applied to dry base coat. 2nd coat applied after 1st coat had set and partly dried.	1931
Sabinito Plaster A	1/2"	.16	.24	.33	.73	.75	.77	.55	1st coat 1/4" 2nd coat 1/4"	Gypsum plaster.	1st coat applied to dry base coat. 2nd coat applied 24 hrs. after 1st coat.	1935
Sabinito Plaster A	3/4"	.13	.27	.59	.81	.74	.85	.60	1st coat 1/4" 2nd coat 1/4" 3rd coat 1/4"	5/4" Gypsum plaster on metal lath.	1st coat applied on dry base coat. 2nd coat applied 48 hrs. after 1st coat. 3rd coat applied 72 hrs. after 2nd coat.	1935
Sabinito Plaster F	1/2"	.19	.22	.45	.80	.75	.75	.55	1st coat 1/4" 2nd coat 1/4"	3/4" Gypsum plaster on metal lath.	1st coat applied on dry base coat. 2nd coat applied 48 hrs. after 1st coat.	1936

Table 3

Audience seated in chairs of various types

- A - cane seat chairs, open back
- B - theatre chairs, box spring seat, heavily padded back
- C - same as B, but single layer of padding on back
- D - church pews, seating five

Absorption per person *

	128	256	512	1024	2048	Date
Women without coats, A	0.7	1.3	2.3	3.6	4.6	1930
Women with coats, A	1.3	2.4	4.0	5.8	6.7	1930
Men without overcoats, A	1.3	2.1	4.1	5.5	7.4	1930
Men with overcoats, A	2.3	3.2	4.8	6.2	7.6	1930
Mixed audience, B			3.9	4.7		1929
Empty seat, B		3.4	3.0	3.3	3.6	1929
Mixed audience, C		3.5	4.1	4.9	4.2	1930
Empty seat, C		3.0	2.5	2.9	3.1	1929
Mixed audience, D		2.7	3.3	3.8	3.6	1930
Plywood Chair,		0.2	0.3	0.5	0.5	1930

* These figures are numerically equal to the number of square feet of a material having an absorption coefficient of 1.00, which would absorb the same amount of sound energy.

Suggestions Concerning the Proper Use
of Acoustical Material.

As there has been considerable misconception as to the proper use of acoustical material it is considered desirable to call attention to two of the fundamental principles underlying the formulas which are used in acoustical design. It is assumed in all of the formulas that (1) the absorption is proportional to the area of the absorbing material and that (2) there is a uniform distribution of sound energy. As a rule neither one of these assumptions is true.

It has been found from experiment when very small areas are used, such as the panels in a coffered ceiling having areas from 1 to 4 square feet and separated from each other by a foot or more, that the effective absorption of the material in these panels is greater than when the material is installed in one large area. In fact, for materials having large coefficients, this effective absorption may be as much as 50 percent more than one would expect from the coefficient.

It has also been found when all of the acoustical material is applied on one surface of a relatively small room, say 50,000 cubic feet or under, that this creates a non-uniform distribution of sound energy in the following manner. Let us assume that the ceiling of a room is covered with a highly absorbent material. Under these conditions the sound energy which is traveling between the floor and ceiling is absorbed quite rapidly, while that traveling between the untreated wall surfaces, having very little to absorb it, may continue for some considerable time. This persistence of sound energy between the untreated surfaces may cause the measured reverberation time to be considerably longer than would be computed using the ordinary reverberation formula and the coefficient usually given. For this reason, it is essential in small rooms that the acoustical material be distributed on the side walls as well as on the ceiling, if the effective absorption of the material is to be anywhere near that which one would expect from the coefficient of the material. For further discussion of this problem see Circular C418.

We also wish to call attention to the fact that a proper distribution of the acoustical material should be worked out in the initial plans of a building, as it is frequently impossible to obtain a satisfactory distribution after the interior design has been completed without taking into account the acoustical treatment.

